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# TEXAS AGRICULTURAL EXPERIMENT STATION

B. YOUNGBLOOD, DIRECTOR
COLLEGE STATION, BRAZOS COUNTY, TEXAS

BULLETIN NO. 372 JANUARY, 1928



DIVISION OF CHEMISTRY

# DIGESTIBILITY AND PRODUCTION COEFFICIENTS OF POULTRY FEEDS

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†As of December 1, 1927.
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## SYNOPSIS

Sixty-three digestion experiments, on poultry, are reported, with a compilation of all other digestion experiments on poultry that could be found. Poultry have little power to digest crude fiber, and feeds containing much crude fiber have a low digestibility. Energy-production coefficients for poultry are given, although the basis for such figures is not very satisfactory. The Bulletin gives the approximate average and minimum chemical composition, digestible protein, and productive energy for a number of poultry feeds. It also tells how to calculate the composition and feeding values of mixtures of feeds.

## CONTENTS

BULLETIN NO. 372 JANUARY, 1928

# DIGESTIBILITY AND PRODUCTION COEFFICIENTS OF POULTRY FEEDS

G. S. FRAPS

The object of this Bulletin is to present information regarding the feeding value of poultry feeds. It contains a tabulation of all digestion experiments that could be found, with averages, and studies of their variability compared with such as were fed ruminants. Energy-production coefficients are given, also digestion coefficients for protein, and the calculated productive energy and digestible protein for average feeds and for the minimum guarantees permitted by the Feed Control Service.

## DIGESTION EXPERIMENTS WITH POULTRY

The number of digestion experiments which have been made with poultry is considerably less than those made on ruminants, but feeds are used in greater variety for ruminants than for poultry. Texas Bulletin 329 contains a tabulation of 1078 American digestion experiments on ruminants. This Bulletin contains 39 foreign experiments and 112 American experiments, a total of 151. Sixty-three of these are here reported for the first time by the Texas Experiment Station.

## THE THREE METHODS USED BY INVESTIGATORS

Digestion experiments with poultry are made more difficult by reason of the fact that the undigested residue and the urinary products are excreted together. Three different methods are used to overcome this difficulty.

The first method consists in estimating the uric acid and ammonia in the mixed excrements, and subtracting the amount from the total. This method assumes that the urinary products consist entirely of uric acid and ammonia, which is not correct. It is the method used to the greatest extent, and was used in the work here presented.

The second method consists in operating on the birds to make an artificial anus, so that the urinary products could be kept separate from the undigested residues. This method was used by Paraschtschuk, Lehmann, Voltz, and partly by Katayama, and the results are designated by the letter O in the table of digestion coefficients (Table 8).

The third method was proposed by Katayama, and was also used by Halnon. It consists in correcting the results secured by analysis of the mixed excreta by means of average factors from analyses of the excreta secured by the operative method. While the average of a number of feeds was used for these factors, only one bird was used in the experimental work. It is a question, therefore, whether there is sufficient basis for this method. Results secured by this method are designated by the letter C in the table of digestion coefficients (Table 8).

## METHODS USED IN EXPERIMENTS HERE REPORTED

The animals were fed 3 days in the preliminary period, and 5 days for the collection of excrement. One gram of alfalfa meal was usually fed at each meal, as this was found to aid in preventing irregular excretion. The excrements were collected in bags attached to the animals for the first 30 experiments. After that, the animals were placed in cages with wire bottoms, and the excrement collected in pans. This method was more satisfactory than the use of bags.

The uric acid and ammonia were estimated by Bartlett's method (Bull. 184, Maine) and subtracted from the mixed excrements. The digestibility of the alfalfa meal was determined in an experiment in which it was fed in large quantity with corn meal. The material digested from the alfalfa meal was subtracted in cases where it was used. As the quantity eaten was small, variations in digestibility of the alfalfa would not affect the digestion coefficient to a material extent. Some of the feeds were fed in mixtures, in which case the digestibility of the supplementary feed was determined in another test, and the results calculated as usual.

## TIME REQUIRED TO EXCRETE FEED RESIDUES

An experiment was made to ascertain the time required to excrete feed residues. A cock that had been a week on a diet of corn was fed two meals of oats, then cracked corn. Crude fiber determinations were made on the dried excrement. The results are in Table 1.

Table 1.—Percentage crude fiber in chicken excrement after feeding oats.

| | | Crude Fiber Per Cent |
|---|---|---|
| Dec. 5 | Before feeding oats—morning | 6.34 |
| | Fed oats 11 a. m. and 4 p. m. | |
| Dec. 5 | Afternoon collection | 4.96 |
| Dec. 6 | Morning | 12.66 |
| Dec. 6 | Afternoon | 15.76 |
| Dec. 7 | Morning | 11.02 |
| Dec. 7–8 | Afternoon and morning | 7.00 |
| Dec. 8 | Afternoon | 4.47 |
| Dec. 9 | Morning | 5.93 |
| Dec. 9 | Afternoon | 3.93 |
| Dec. 10 | Morning | 3.77 |
| Dec. 11 | Morning | 3.85 |

The crude fiber of the oats affected the excrement 24 hours after the first meal and reached a maximum 24 hours after the second meal. Three days after the second meal of oats, the crude fiber of the oats no longer had any effect on the excrement.

Kaup and Ivey made some experiments using lamp black or dyes in the feed, and found the material to appear in the excrement in about 4 hours with laying birds and pullets. The hen which was not laying, took 8 hours to begin to pass the additions and the broody hen took 12 hours.

## FEEDS USED IN THE DIGESTION EXPERIMENTS

The chemical composition of the feeds used are given in Table 2. The brown rice used was rice from which the husk had been taken off, but the bran had not been removed. The polished rice was rice from which both the husk and the bran had been removed. The character of the other feeds is shown in the table. The digestion coefficients are given in Table 8.

Table 2.—Composition of feeds used in digestion experiments.

| Laboratory Number | | Protein | Ether Extract | Crude Fiber | Nitrogen-free Extract | Water | Ash | Number in Table |
|---|---|---|---|---|---|---|---|---|
| 24427 | Alfalfa leaf meal, D. E. No. 56 | 22.80 | 2.19 | 15.21 | 38.70 | 7.95 | 13.15 | 105 |
| 19813 | Alfalfa meal (low grade) D.E. No. 9 | 11.18 | 1.55 | 34.51 | 38.77 | 6.59 | 7.40 | 58 |
| 24286 | Barley, whole, D. E. No. 52 | 11.21 | 1.84 | 5.49 | 67.43 | 11.20 | 2.83 | 101 |
| 22186 | Barley, whole, D. E. No. 33 | 10.66 | 1.58 | 6.56 | 69.74 | 8.33 | 3.13 | 82 |
| 21958 | Barley, whole, D. E. No. 26 | 10.98 | 1.70 | 6.61 | 68.16 | 10.31 | 2.24 | 75 |
| 20820 | Barley, whole, D. E. No. 18 | 13.83 | 1.61 | 12.33 | 59.96 | 9.27 | 3.00 | 67 |
| 22818 | Blood meal, Red, D. E. No. 40 | 77.95 | 1.08 | 2.16 | 2.99 | 10.14 | 5.68 | 89 |
| 22246 | Buckwheat, whole, D. E. No. 36 | 11.42 | 2.27 | 13.88 | 61.59 | 9.06 | 1.78 | 85 |
| 20833 | Buckwheat, whole, D. E. No. 19 | 10.64 | 2.38 | 11.85 | 62.75 | 10.80 | 1.58 | 68 |
| 19466 | Corn chops, D. E. No. 3 | 9.15 | 4.19 | 2.89 | 72.86 | 9.56 | 1.34 | 52 |
| 19868 | Corn chops, Mexican, D. E. No. 7 | 11.50 | 5.95 | 2.97 | 69.59 | 8.68 | 1.31 | 56 |
| 19918 | Corn meal, D. E. No. 8 | 9.15 | 3.02 | 1.24 | 74.50 | 11.08 | 1.01 | 57 |
| 23922 | Corn meal, D. E. No. 51 | 10.38 | 3.24 | 1.66 | 73.44 | 10.12 | 1.16 | 100 |
| 22765 | Corn meal, D. E. No. 38 | 10.09 | 3.15 | 1.03 | 74.43 | 10.11 | 1.19 | 87 |
| 20016 | Cottonseed meal, D. E. No. 11 | 45.45 | 8.92 | 8.15 | 23.70 | 7.50 | 6.28 | 60 |
| 22719 –20 | Cottonseed meal, D. E. No. 39 | 44.35 | 6.90 | 11.36 | 25.39 | 6.17 | 5.85 | 88 |
| 23040 | Cowpeas, D. E. No. 45 | 23.17 | 1.52 | 4.93 | 59.02 | 7.72 | 3.64 | 94 |
| 24782 | Darso, D. E. No. 60 | 11.43 | 3.34 | 2.38 | 73.24 | 8.13 | 1.48 | 109 |
| 22123 | Darso, D. E. No. 29 | 12.14 | 3.31 | 2.69 | 70.65 | 9.53 | 1.68 | 78 |
| 19851 | Darso, D. E. No. 6 | 11.25 | 3.77 | 3.30 | 71.50 | 8.85 | 1.33 | 55 |
| 24807 | Feterita, D. E. No. 61 | 13.03 | 3.42 | 2.48 | 69.47 | 9.78 | 1.82 | 110 |
| 24711 | Feterita (Spur), D. E. No. 59 | 12.86 | 2.88 | 2.25 | 70.40 | 9.96 | 1.65 | 108 |
| 22145 | Feterita (Spur), D. E. No. 30 | 13.44 | 3.67 | 2.46 | 69.65 | 9.13 | 1.65 | 79 |
| 21766 | Feterita (Spur), D. E. No. 22 | 13.78 | 3.59 | 2.35 | 67.58 | 11.19 | 1.51 | 71 |
| 19830 | Feterita (Spur), D. E. No. 5 | 12.49 | 3.42 | 2.60 | 70.91 | 9.22 | 1.36 | 54 |
| 22114 | Kafir (black hull), D. E. No. 28 | 11.05 | 2.90 | 2.19 | 71.55 | 10.92 | 1.39 | 77 |
| 24854 | Kafir (black hull), D. E. No. 63 | 12.12 | 3.07 | 2.24 | 71.21 | 9.81 | 1.55 | 112 |
| 21049 | Kafir (Dwarf), D. E. No. 21 | 11.27 | 2.70 | 2.05 | 72.75 | 10.24 | .99 | 70 |
| 22815 | Meat meal, D. E. No. 41 | 61.00 | 9.13 | 3.39 | 3.15 | 7.61 | 15.72 | 90 |
| 22196 | Millet, D. E. No. 34 | 11.45 | 3.77 | 9.54 | 62.33 | 9.62 | 3.29 | 83 |
| 24414 | Milo, D. E. No. 55 | 10.44 | 2.38 | 2.69 | 71.63 | 11.10 | 1.76 | 104 |
| 23160 | Milo, D. E. No. 49 | 11.91 | 2.58 | 1.83 | 71.21 | 10.95 | 1.52 | 98 |
| 22168 | Milo, D. E. No. 32 | 17.60 | 1.73 | 22.95 | 38.92 | 9.20 | 9.60 | 81 |
| 24846 | Milo (Dwarf yellow), D. E. No. 62 | 11.21 | 2.65 | 3.05 | 70.43 | 10.58 | 2.08 | 111 |
| 21825 | Milo (Dwarf yellow), D. E. No. 24 | 10.69 | 3.30 | 1.79 | 72.63 | 10.20 | 1.39 | 73 |
| 19823 | Milo (Dwarf yellow), D. E. No. 4 | 9.53 | 3.02 | 2.59 | 74.24 | 9.38 | 1.24 | 53 |
| 22909 | Milo (Dwarf yellow), D. E. No. 42 | 10.75 | 3.27 | 2.40 | 72.75 | 9.47 | 1.36 | 91 |
| 19426 | Oat groats, D. E. No. 2 | 16.59 | 6.09 | 2.03 | 65.18 | 8.25 | 1.86 | 51 |
| 24655 | Oat, whole, D. E. No. 57 | 13.29 | 3.97 | 10.25 | 60.92 | 8.44 | 3.53 | 106 |
| 19416 | Oats, whole, D. E. No. 1 | 11.93 | 4.25 | 10.59 | 60.99 | 8.87 | 3.37 | 50 |
| 23087 –8 | Rice bran, D. E. No. 53 | 14.65 | 14.58 | 13.60 | 37.08 | 8.64 | 11.47 | 102 |
| 23087 –8 | Rice bran, D. E. No. 46 | 14.65 | 16.58 | 13.60 | 37.08 | 8.46 | 11.47 | 95 |
| 20565 –6 | Rice bran, D. E. No. 15 | 13.21 | 13.86 | 15.91 | 37.65 | 7.60 | 11.78 | 64 |
| 20843 | Rice (brown), D. E. No. 20 | 10.08 | 2.13 | 1.16 | 76.55 | 9.26 | 0.82 | 69 |
| 23115 –6 | Rice polish, D. E. No. 47 | 14.35 | 13.73 | 2.61 | 55.67 | 7.94 | 5.72 | 96 |
| 20577 | Rice polish, D. E. No. 16 | 12.47 | 10.40 | 2.53 | 60.86 | 8.26 | 5.48 | 65 |
| 20540 | Rice grain (polished), D. E. No. 14 | 8.48 | 0.14 | 0.40 | 81.06 | 9.54 | 0.38 | 63 |
| 20102 | Rice (whole Japan), D. E. No. 12 | 7.78 | 1.96 | 8.84 | 66.74 | 10.15 | 4.53 | 61 |

Table 2.—Composition of feeds used in digestion experiments—(continued).

| Laboratory Number | | Protein | Ether Extract | Crude Fiber | Nitrogen-free Extract | Water | Ash | Number in Table |
|---|---|---|---|---|---|---|---|---|
| 22218 | Rice (whole), D. E. No. 35 | 12.50 | 1.79 | 2.54 | 71.96 | 9.21 | 2.00 | 84 |
| 22991 | Shallu, D. E. No. 44 | 14.11 | 3.86 | 2.33 | 70.14 | 7.91 | 1.65 | 93 |
| 21969 | Shallu, D. E. No. 27 | 12.53 | 3.11 | 2.53 | 67.63 | 12.00 | 2.20 | 76 |
| 21787 | Sorghum seed (Sumac), D.E. No. 23 | 10.45 | 3.62 | 2.09 | 71.75 | 10.65 | 1.44 | 72 |
| 22161 | Sorghum seed (Sumac), D.E. No. 31 | 11.82 | 3.58 | 2.71 | 71.43 | 8.97 | 1.49 | 80 |
| 22964 | Sorghum seed (Sumac), D. E. No.43 | 10.35 | 3.28 | 2.59 | 73.14 | 8.90 | 1.74 | 92 |
| 24681 | Sorghum (Sumac), D. E. No. 58 | 10.20 | 3.49 | 2.40 | 72.43 | 9.89 | 1.59 | 107 |
| 22257 | Soy beans, D. E. No. 37 | 38.90 | 17.83 | 7.79 | 22.43 | 7.92 | 5.13 | 86 |
| 20713 | Tankage, D. E. No. 17 | 70.15 | 12.50 | 1.94 | 2.76 | 7.17 | 5.48 | 66 |
| 21930 | Wheat, D. E. No. 25 | 14.37 | 1.78 | 3.79 | 68.22 | 9.74 | 2.10 | 74 |
| 20015 | Wheat, D. E. No. 10 | 14.03 | 1.65 | 3.28 | 68.75 | 10.35 | 1.94 | 59 |
| 23183 | Wheat bran, D. E. No. 50 | 17.50 | 4.09 | 9.48 | 54.37 | 8.43 | 6.13 | 99 |
| 20193 | Wheat bran, D. E. No. 13 | 16.83 | 3.51 | 9.64 | 52.37 | 11.76 | 5.89 | 62 |
| 23159 | Wheat gray shorts, D. E. No. 48 | 19.87 | 4.61 | 4.69 | 57.22 | 10.01 | 3.60 | 97 |
| 24383 –4 | Wheat gray shorts, D. E. No. 54 | 19.25 | 5.35 | 5.07 | 57.00 | 8.96 | 4.39 | 103 |

## COMPILATION OF DIGESTION EXPERIMENTS

Table 8 contains a compilation of all digestion experiments with poultry that could be found by the author, up to May 1, 1927. The individual experiments and the averages are given, with reference numbers and designation of the method of calculation.

## VARIATION IN DIGESTION COEFFICIENTS

The probable error and the per cent error of numbers of the experiments is given in Table 3. The probable error is the standard deviation divided by the square root of the number of determinations and multiplied by .6745. The per cent error is .6745 times the ordinary coefficient of variation, which is secured by dividing the standard deviation by the average coefficient of digestibility and expressing the results in per cent.

Table 3.—Variation in digestion coefficients of poultry.

| Name of Feed | Number Averaged | Protein | Fat | Nitrogen-free Extract |
|---|---|---|---|---|
| Barley | 21 | 72.0 ±1.3 | 58.1 ±1.7 | 82.1 ± .5 |
| Per cent error | | 8.2 | 13.0 | 2.7 |
| Buckwheat | 12 | 61.2 ±1.7 | 86.3 ± .7 | 83.9 ± .6 |
| Per cent error | | 9.7 | 2.8 | 2.5 |
| Corn and corn meal | 43 | 73.6 ±1.4 | 86.9 ± .6 | 90.2 ± .3 |
| Per cent error | | 12.2 | 4.7 | 2.7 |
| Cottonseed meal | 8 | 76.1 ±2.6 | 86.2 ±2.5 | 85.7 ±1.4 |
| Per cent error | | 9.8 | 8.1 | 4.7 |
| Fish scraps | 11 | 90.7 ± .5 | 95.7 ± .7 | 15.4 ±6.8 |
| Per cent error | | 2.0 | 2.4 | 99.0 |
| Kafir | 17 | 66.8 ±2.8 | 78.1 ± .9 | 91.7 ± .9 |
| Per cent error | | 17.5 | 5.0 | 4.0 |

Table 3.—Variation in digestion coefficients of poultry—(continued).

| Name of Feed | Number Averaged | Protein | Fat | Nitrogen-free Extract |
|---|---|---|---|---|
| Milo | 12 | 83.3 ±1.7 | 77.5 ±2.3 | 91.5 ± .8 |
| Per cent error | | 7.1 | 10.3 | 3.0 |
| Oat groats | 11 | 76.7 ±1.6 | 88.6 ±1.0 | 90.5 ±1.3 |
| Per cent error | | 7.0 | 3.9 | 4.7 |
| Oats, whole | 21 | 74.1 ± .7 | 81.7 ± .9 | 69.3 ± .6 |
| Per cent error | | 4.4 | 4.8 | 4.0 |
| Peas and cowpeas | 11 | 59.2 ±4.2 | 86.1 ±1.5 | 86.4 ± .9 |
| Per cent error | | 23.3 | 5.6 | 3.5 |
| Rice bran | 9 | 57.9 ±2.8 | 87.1 ± .6 | 52.3 ±2.1 |
| Per cent error | | 14.3 | 2.0 | 12.1 |
| Rough rice | 10 | 74.2 ± .8 | 72.2 ±5.0 | 83.8 ±1.1 |
| Per cent error | | 3.6 | 21.8 | 4.1 |
| Tankage and meat meal | 11 | 86.2 ±1.6 | 94.1 ±1.0 | 45.6 ±8.6 |
| Per cent error | | 6.1 | 3.4 | 62.2 |
| Wheat | 34 | 74.0 ±1.1 | 47.1 ±1.4 | 88.9 ± .3 |
| Per cent error | | 8.6 | 17.6 | 2.0 |
| Wheat bran | 11 | 59.9 ±3.3 | 50.0 ±2.0 | 54.1 ±2.0 |
| Per cent error | | 18.3 | 13.3 | 12.1 |
| Wheat flour middlings | 9 | 50.0 ±1.8 | 52.6 ± .9 | 49.7 ±1.0 |
| Per cent error | | 10.6 | 5.0 | 5.8 |
| Wheat standard middlings | 9 | 76.2 ± .5 | 52.6 ±3.2 | 59.6 ± .6 |
| Per cent error | | 2.0 | 18.1 | 2.8 |

There is more variation with poultry than with ruminants, with protein and fat; there is no great difference with nitrogen-free extract for the feeds compared.

## RELATION OF DIGESTION COEFFICIENTS OF POULTRY TO THOSE OF RUMINANTS

Table 4 compares the coefficients of digestibility for poultry and for ruminants. Ruminants have, on an average, a higher digestive power than poultry. The difference is greater for crude fiber, which is almost indigestible for poultry.

Table 4.—Comparative digestion coefficients for poultry and for ruminants.

| | Protein | Ether Extract | Crude Fiber | Nitrogen-free Extract | No. Averaged |
|---|---|---|---|---|---|
| Alfalfa, 35% fiber, Poultry | 63.4 | 21.8 | 1.4 | 34.4 | 2 |
| Alfalfa, over 33% fiber, Ruminant | 69.3 | 32.3 | 46.4 | 68.8 | 20 |
| Difference | —5.9 | —10.5 | —45.0 | —34.4 | |
| Barley (whole), Poultry | 72.0 | 58.1 | 10.8 | 82.1 | 21 |
| Barley, grain, Ruminant | 80.3 | 78.6 | 58.7 | 91.8 | |
| Difference | —8.3 | —20.5 | —47.9 | —9.7 | |
| Corn and corn meal, Poultry | 73.6 | 86.9 | 13.2 | 90.2 | 43 |
| Corn meal and chops, Ruminants | 64.1 | 88.4 | 30.6 | 92.3 | 15 |
| Difference | 9.5 | —1.5 | —17.4 | —2.1 | |
| Cottonseed meal, Poultry | 76.1 | 86.2 | 11.9 | 85.7 | 8 |
| Ruminants | 84.4 | 96.4 | 28.0 | 64.4 | 9 |
| Difference | —8.3 | —10.2 | —16.1 | 21.3 | |

Table 4.—Comparative digestion coefficients for poultry and for ruminants—(continued).

| | Protein | Ether Extract | Crude Fiber | Nitrogen-free Extract | No. Averaged. |
|---|---|---|---|---|---|
| Feterita, Poultry | 87.8 | 80.7 | 33.2 | 91.3 | 10 |
| Ruminants | 76.5 | 73.7 | 16.7 | 91.5 | 3 |
| Difference | 11.3 | 7.0 | 16.5 | — .2 | |
| Kafir (grain or meal), Poultry | 66.8 | 78.1 | 18.0 | 91.7 | 17 |
| Kafir, balanced ration, Ruminants | 72.6 | 76.8 | 26.0 | 88.8 | 2 |
| Difference | —5.8 | 1.3 | —8.0 | 2.9 | |
| Millet, Poultry | 76.1 | 77.9 | 16.9 | 87.0 | 2 |
| Ruminants | 68.3 | 87.3 | 25.6 | 90.6 | 3 |
| Difference | 7.8 | —9.4 | —8.7 | —3.6 | |
| Milo, Poultry | 83.3 | 77.5 | 31.2 | 91.5 | 12 |
| Ruminants | 76.9 | 89.2 | 36.2 | 90.1 | 2 |
| Difference | 6.4 | —11.7 | —5.0 | 1.4 | |
| Oats, whole, Poultry | 74.1 | 81.7 | 7.1 | 69.3 | 21 |
| Oats, 10–12% fiber, Ruminants | 79.0 | 86.4 | 41.6 | 81.9 | |
| Difference | —4.9 | —4.7 | —34.5 | —12.6 | |
| Peanut meats, Poultry | 80.3 | 78.4 | 4.1 | 84.2 | 5 |
| Peanut meal, Ruminants | 88.8 | 95.2 | 37.2 | 83.8 | ..... |
| Difference | —8.5 | —16.8 | —33.1 | .4 | |
| Rice bran, Poultry | 57.9 | 87.1 | 3.0 | 52.3 | 9 |
| Ruminants | 69.3 | 82.8 | 22.6 | 75.6 | 5 |
| Difference | —11.4 | 4.3 | —19.6 | —23.3 | |
| Rice polish, Poultry | 80.9 | 94.8 | 4.3 | 89.3 | 4 |
| Ruminants | 67.9 | 85.9 | 14.9 | 92.2 | 4 |
| Difference | 13.0 | 8.9 | —10.6 | —2.9 | |
| Rice, rough, Poultry | 74.2 | 72.2 | 5.1 | 83.8 | 10 |
| Ruminants | 75.6 | 76.2 | 10.4 | 90.7 | 3 |
| Difference | —1.4 | —4.0 | —5.3 | —6.9 | |
| Wheat gray shorts, Poultry | 69.2 | 85.2 | 13.0 | 71.0 | 4 |
| Ruminants | 83.9 | 87.2 | 17.6 | 90.8 | 5 |
| Difference | —14.7 | —2.0 | —4.6 | —19.8 | |
| Wheat bran, Poultry | 59.9 | 50.0 | 7.9 | 54.1 | 11 |
| Ruminants | 78.4 | 69.8 | 30.4 | 72.2 | 12 |
| Difference | —18.5 | —19.8 | —22.5 | —18.1 | |
| Wheat, Poultry | 74.0 | 47.1 | 8.7 | 88.9 | 34 |
| Ruminants | 81.9 | 77.4 | 55.3 | 45.0 | 5 |
| Differences | —7.9 | —30.3 | —46.6 | 43.9 | |
| Average difference +poultry larger | 9.6 | 5.4 | 16.5 | 14.0 | |
| Average—ruminants larger | 8.7 | 11.8 | 21.7 | 12.2 | |
| Number difference +poultry larger | 5 | 4 | 1 | 5 | |
| Number—ruminants larger | 11 | 12 | 15 | 11 | |
| Average algebraic difference of all ruminants larger | 8.98 | 10.18 | 21.40 | 12.72 | |

The table includes 16 comparisons. For protein the digestibility is higher for poultry in 5 cases, lower in 5, the average algebraic difference being 2.9 per cent, in favor of ruminants, which is comparatively small.

For fat the digestibility with poultry is higher in 4 cases, lower in 12, the average difference being 8.2 per cent in favor of ruminants.

For crude fiber the digestibility with poultry is higher in one case, lower in 15, with an average difference of 19.4 per cent in favor of ruminants.

For nitrogen-free extract, the digestibility with poultry is higher in 5 cases, lower in 11, with an average difference of 4.4 per cent in favor of ruminants.

The differences are chiefly in the fat and crude fiber. The differences are less for feeds which contain little fiber, such as corn, milo, kafir, than they are for materials containing crude fiber, such as alfalfa, barley with hull, oats with hull, rice bran or wheat bran. This means that poultry do not have the ability to digest well such substances as alfalfa meal, oat hulls, barley hulls, rice hulls, and wheat bran, which are low in starches and sugar, and contain more woody material than the grains and similar concentrates.

Table 5.—Comparative variation in digestion coefficients of poultry and ruminants (per cent error).

| | Protein | Ether Extract | Nitrogen-free Extract |
|---|---|---|---|
| Barley: | | | |
| Poultry | 8.2 | 13.0 | 2.7 |
| Ruminant | 5.2 | 10.2 | 1.6 |
| Corn and corn meal: | | | |
| Poultry | 12.2 | 4.7 | 2.1 |
| Ruminant | 13.4 | 5.5 | 3.7 |
| Cottonseed meal: | | | |
| Poultry | 9.8 | 8.1 | 4.7 |
| Ruminant | 4.5 | 3.2 | 17.1 |
| Oats, whole: | | | |
| Poultry | 4.4 | 4.8 | 4.0 |
| Ruminant | 3.8 | 3.6 | 3.2 |
| Rice bran: | | | |
| Poultry | 14.3 | 2.0 | 12.1 |
| Ruminant | 6.8 | 11.6 | 4.0 |
| Rice, rough: | | | |
| Poultry | 3.6 | 21.8 | 4.1 |
| Ruminant | 4.7 | 7.4 | 1.0 |
| Wheat: | | | |
| Poultry | 8.6 | 17.6 | 2.0 |
| Ruminant | 7.6 | 9.5 | 1.5 |
| Wheat bran: | | | |
| Poultry | 18.3 | 13.3 | 12.1 |
| Ruminant | 4.4 | 14.0 | 4.9 |

Table 5 compares the per cent error in experiments with poultry and with ruminants. There is more error with poultry than with ruminants.

## ENERGY-PRODUCTION COEFFICIENTS FOR POULTRY FEEDS

The basis for calculating energy-production coefficient for poultry feeds is very small, and the author hesitated for some time before undertaking to do so. It was finally decided to calculate them, for while they are not exact, they would be more nearly correct than estimates from the digestible materials alone, and they could serve as a starting point for more exact coefficients.

Table 6.—Productive coefficients for poultry.

| | Protein | Fat | Crude Fiber | Nitrogen-free Extract | Factor | Protein (Digestible) |
|---|---|---|---|---|---|---|
| Alfalfa meal | .644 | .445 | 0 | .368 | C | .634 |
| Barley, whole | .695 | 1.255 | 0 | .835 | B.95 | .720 |
| Blood meal | .929 | 1.052 | 0 | .511 | B | .914 |
| Buckwheat | .622 | 1.962 | 0 | .899 | B | .612 |
| Buttermilk, dried | .829 | 1.787 | 0 | .869 | B | .816 |
| Clover and corn meal | .729 | 1.523 | 0 | .660 | B | .718 |
| Corn | .761 | 1.934 | 0 | .965 | B | .749 |
| Corn meal | .729 | 2.082 | 0 | .984 | B | .718 |
| Corn meal (bolted) | .752 | 1.962 | 0 | .945 | B | .740 |
| Corn meal (unbolted) | .747 | 1.921 | 0 | .939 | B | .735 |
| Corn, corn meal, bolted and unbolted | .748 | 1.975 | 0 | .966 | B | .736 |
| Corn meal, 7 parts; beef scraps, 1 part | .836 | 1.680 | 0 | .982 | B | .823 |
| Corn meal and beef scraps | .914 | 2.148 | 0 | .829 | B | .900 |
| Cottonseed meal | .773 | 2.229 | 0 | .918 | A | .761 |
| Peas and cowpeas | .601 | 1.957 | 0 | .925 | B | .592 |
| Darso | .366 | 1.946 | 0 | .952 | B | .360 |
| Feterita | .892 | 1.834 | 0 | .978 | B | .878 |
| Fish meal, dried fish, fish meal | .922 | 2.475 | 0 | .165 | A | .907 |
| Getrocknete Gemuse | .666 | .442 | 0 | .594 | C.8 | .819 |
| India wheat | .724 | 1.810 | 0 | .848 | B.95 | .750 |
| Kafir (grain or meal) | .679 | 1.775 | 0 | .982 | B | .668 |
| Meat meal, meat and bone meal | .881 | 2.408 | 0 | .364 | A | .867 |
| Millet | .773 | 1.771 | 0 | .932 | B | .761 |
| Milo | .846 | 1.762 | 0 | .980 | B | .833 |
| Oat groats | .779 | 2.291 | 0 | .969 | A | .767 |
| Oats, whole | .753 | 1.857 | 0 | .742 | B | .741 |
| Peanut meats | .816 | 2.027 | 0 | .902 | A | .803 |
| Peas | .895 | 1.846 | 0 | .933 | B | .881 |
| Potatoes | .477 | 0 | 0 | .905 | B | .469 |
| Potatoes and oats | .555 | 1.123 | 0 | .991 | B | .546 |
| Potatoes, rye and starch | .488 | .759 | 0 | .894 | B | .480 |
| Potatoes (sweet) | 0 | .561 | 0 | .828 | B | 0 |
| Rice bran | .529 | 2.027 | 0 | .504 | A.90 | .579 |
| Rice (brown) | .854 | 1.998 | 0 | 1.051 | B | .841 |
| Brown rice and clover | .790 | .882 | 0 | .952 | B | .778 |
| Rice polish | .822 | 2.452 | 0 | .956 | A | .809 |
| Rice, polished | .804 | .119 | 0 | 1.053 | A | .791 |
| Rice, rough | .754 | 1.641 | 0 | .897 | B | .742 |
| Rye | .663 | .714 | 0 | .921 | B | .653 |
| Shallu | .790 | 1.923 | 0 | 1.005 | B | .778 |
| Sorghum seed, Sumac | .163 | 1.912 | 0 | .942 | B | .160 |
| Soy beans | .710 | 2.405 | 0 | .818 | A | .699 |
| Soy bean oil meal | .846 | 2.105 | 0 | .891 | A | .833 |
| Soy bean oil cake | .846 | 2.131 | 0 | .859 | A | .833 |
| Tankage | .867 | 2.180 | 0 | .466 | B | .853 |
| Tankage and meat meal | .862 | .941 | 0 | .456 | B | .862 |
| Wheat middlings 6.25% fiber | .432 | 1.017 | .082 | .452 | B.85 | .500 |
| Wheat gray shorts | .633 | 1.743 | .125 | .684 | B.90 | .692 |
| Wheat bran | .499 | .932 | .070 | .475 | B.82 | .599 |
| Wheat | .752 | 1.071 | 0 | .952 | B | .740 |
| Wheat middlings 8.5% fiber | .658 | 1.017 | .075 | .542 | B.85 | .762 |

The energy-production coefficients were accordingly calculated (Table 6) by the method given on page 17 of Bulletin 329, except that the correction for crude fiber was omitted. The factors used for fat, and for correcting all the values, if used, are given in the last column. These values are calculated from average digestion coefficients given in Table 8.

## USE OF THE PRODUCTION COEFFICIENTS

The digestible protein can be calculated by multiplying the percentage of protein in the feed by the factor given in the next to the last column of Table 8. The productive energy can be calculated by multiplying each constituent of the feed by the factor given in the table, and adding the product. The result will be in therms for 100 pounds. If the feed concerned is not listed in the table, the best that can be done is to select the factors of the feed that resemble it the closest.

## COMPOSITION AND PRODUCTIVE VALUES OF POULTRY FEEDS

The average composition, productive energy, and digestible protein of a number of Texas poultry feeds are given in Table 7. The average composition assumed is based upon analyses made for the Feed Control Service for the past two years, upon other analyses made in the laboratory, and upon other data.

Table 7.—Average composition and minimum guarantee for Texas and productive values of poultry feeds.

| | Protein | Ether Extract | Crude Fiber | Nitrogen-free Extract | Water | Ash | Productive Energy | Digestible Protein |
|---|---|---|---|---|---|---|---|---|
| Alfalfa chopped, Min. | 13.0 | 1.5 | 32.0 | 35.0 | 11.5 | 7.0 | 10.5 | 13.0 |
| Alfalfa leaf meal, Av. | 18.0 | 1.5 | 20.0 | 43.0 | 10.0 | 7.5 | 28.1 | 18.0 |
| Alfalfa meal, Av. | 14.6 | 1.8 | 31.0 | 33.5 | 10.7 | 8.4 | 22.6 | 9.3 |
| Alfalfa meal or hay, Min. | 13.0 | 1.5 | 30.0 | 35.0 | 13.5 | 7.0 | 21.9 | 8.2 |
| Barley, Min. | 11.0 | 1.5 | 7.0 | 65.0 | 12.5 | 3.0 | 63.8 | 7.9 |
| Barley, whole, Av. | 12.0 | 2.2 | 6.6 | 66.0 | 10.3 | 2.9 | 66.2 | 8.6 |
| Bean meal, Min. | 21.0 | 1.4 | 6.0 | 60.0 | 10.0 | 1.6 | 70.9 | 12.4 |
| Blood meal, Av. | 82.3 | 0.9 | .0 | 3.8 | 3.3 | 9.7 | 79.4 | 75.2 |
| Blood, dried, Min. | 80.0 | 1.0 | 2.0 | 3.0 | 11.0 | 3.0 | 76.9 | 73.1 |
| Bone meal, Min. | 23.0 | 7.0 | 1.0 | 1.0 | 5.0 | 63.0 | 35.7 | 19.6 |
| Bone (poultry), Av. | 25.5 | 5.0 | .0 | 2.4 | 6.1 | 61.0 | 35.4 | 22.1 |
| Buckwheat, Av. | 10.7 | 2.2 | 11.0 | 62.0 | 12.3 | 1.8 | 66.7 | 6.6 |
| Buckwheat, whole, Min. | 10.0 | 2.5 | 10.0 | 62.0 | 13.5 | 2.0 | 66.9 | 6.1 |
| Bur clover, young, dried, Av. | 24.0 | 3.2 | 17.0 | 38.1 | 7.5 | 10.2 | 40.0 | 19.7 |
| Buttermilk, dried, Av. | 32.6 | 6.5 | 0.5 | 33.4 | 13.0 | 14.0 | 67.7 | 26.6 |
| Buttermilk, dried, Min. | 32.0 | 6.0 | 1.0 | 35.0 | 18.0 | 11.0 | 67.7 | 26.1 |
| Clover, red (green) (dry basis), Av. | 14.1 | 3.4 | 25.1 | 40.6 | 9.6 | 7.2 | 35.0 | 11.6 |
| Cocoanut cake or meal, Min. | 20.0 | 6.0 | 14.0 | 43.0 | 11.0 | 6.0 | 68.3 | 15.2 |
| Cod liver oil meal, Av. | 52.0 | 25.0 | 1.0 | 10.0 | 9.0 | 3.0 | 105.1 | 39.6 |
| Corn, Av. | 10.0 | 3.8 | 2.3 | 71.0 | 11.3 | 1.6 | 83.5 | 7.5 |
| Corn chops, Min. | 9.0 | 3.5 | 3.0 | 70.0 | 13.0 | 1.5 | 67.2 | 6.7 |
| Corn feed meal, Av. | 10.2 | 4.1 | 2.9 | 71.0 | 10.2 | 1.6 | 85.8 | 7.3 |
| Corn feed meal, Min. | 8.0 | 3.0 | 3.0 | 70.0 | 14.0 | 2.0 | 77.5 | 5.9 |
| Corn germ meal, Min. | 18.0 | 7.0 | 10.0 | 50.0 | 11.0 | 4.0 | 76.9 | 12.9 |
| Corn gluten feed, Min. | 40.0 | 1.0 | 4.0 | 40.0 | 11.0 | 4.0 | 70.6 | 28.7 |

Table 7.—Average composition and minimum guarantee for Texas and productive values of poultry feeds—(continued).

| | Protein | Ether Extract | Crude Fiber | Nitrogen-free Extract | Water | Ash | Productive Energy | Digestible Protein |
|---|---|---|---|---|---|---|---|---|
| Corn gluten feed, Min | 23.0 | 2.5 | 7.0 | 50.0 | 13.5 | 4.0 | 71.2 | 16.5 |
| Corn meal, bolted, Av | 8.5 | 3.5 | 2.0 | 73.0 | 11.5 | 1.5 | 82.3 | 6.3 |
| 43% protein cottonseed meal, Av | 43.0 | 7.5 | 11.0 | 27.0 | 6.2 | 5.3 | 74.8 | 32.7 |
| 43% protein cottonseed meal or cake, Min | 43.0 | 6.0 | 12.0 | 23.0 | 10.5 | 5.5 | 67.7 | 32.7 |
| Cowpeas, Av | 23.0 | 1.5 | 4.9 | 58.0 | 9.0 | 3.6 | 70.4 | 13.6 |
| Emmer, Min | 11.0 | 1.5 | 10.0 | 63.0 | 10.0 | 4.5 | 64.9 | 4.0 |
| Feterita, Av | 12.7 | 2.8 | 2.4 | 69.1 | 11.2 | 1.8 | 84.1 | 11.2 |
| Feterita, Min | 11.0 | 2.8 | 3.0 | 69.0 | 12.2 | 2.0 | 82.5 | 9.7 |
| Fish meal (variable), Min | 45.0 | 5.0 | 1.0 | 1.0 | 26.0 | 22.0 | 54.0 | 40.8 |
| Fish meal or scraps, 60% protein, Av | 60.9 | 14.1 | 0.5 | 2.6 | 7.1 | 14.8 | 91.5 | 55.2 |
| Flour, red dog, Av | 16.5 | 4.0 | 3.5 | 62.5 | 10.4 | 3.1 | 60.6 | 11.4 |
| Flour, red dog, Min | 15.0 | 4.5 | 4.0 | 63.0 | 11.5 | 2.0 | 76.1 | 11.1 |
| Hegari, Av | 12.0 | 1.5 | 2.0 | 69.8 | 13.4 | 1.3 | 81.2 | 10.0 |
| Kafir, Min | 10.0 | 2.5 | 3.5 | 69.5 | 13.0 | 1.5 | 79.5 | 6.7 |
| Kafir, Av | 10.6 | 2.7 | 2.3 | 69.9 | 12.8 | 1.7 | 80.6 | 7.1 |
| Linseed meal, old process, Min | 32.0 | 6.0 | 9.0 | 35.0 | 12.5 | 5.5 | 70.2 | 24.4 |
| Linseed meal, 34% protein, Min | 34.0 | 6.0 | 9.0 | 35.0 | 11.0 | 5.0 | 71.8 | 25.9 |
| Linseed meal, Av | 35.0 | 6.7 | 8.2 | 36.4 | 8.5 | 5.2 | 75.7 | 26.9 |
| Meat and bone meal, 50%, Av | 50.5 | 10.0 | 2.2 | 5.0 | 9.2 | 23.1 | 70.4 | 43.8 |
| Meat and bone scraps, Av | 52.3 | 9.7 | 2.0 | 7.3 | 5.2 | 23.5 | 72.1 | 45.3 |
| Meat and bone scraps, Av | 50.0 | 6.0 | 3.0 | 5.0 | 14.0 | 22.0 | 58.8 | 42.7 |
| Meat scraps, Av | 66.0 | 10.0 | 3.0 | 3.1 | 3.9 | 14.0 | 83.4 | 57.2 |
| Meat scraps (variable), Min | 50.0 | 6.0 | 3.0 | 5.0 | 18.0 | 18.0 | 58.8 | 42.7 |
| Milk, dried skim, Min | 20.0 | 1.0 | 1.0 | 59.0 | 14.0 | 5.0 | 69.6 | 16.3 |
| Millet, Av | 12.1 | 4.1 | 8.4 | 61.0 | 10.8 | 3.6 | 73.5 | 9.2 |
| Millet seed, Min | 11.0 | 4.0 | 10.0 | 57.0 | 13.0 | 5.0 | 68.7 | 8.4 |
| Milo, Av | 11.1 | 2.9 | 2.5 | 71.4 | 10.3 | 1.8 | 84.5 | 9.3 |
| Milo chops, Min | 10.0 | 2.5 | 3.5 | 70.0 | 12.0 | 2.0 | 81.5 | 8.3 |
| Oat groats, Av | 16.4 | 5.9 | 1.9 | 66.0 | 8.0 | 1.8 | 90.3 | 12.6 |
| Oat groats, Min | 15.0 | 6.0 | 1.0 | 65.0 | 11.0 | 2.0 | 88.4 | 11.5 |
| Oats, whole, Min | 11.0 | 4.0 | 12.0 | 58.0 | 10.5 | 4.5 | 58.8 | 8.2 |
| Oats, whole, Av | 12.2 | 4.7 | 11.5 | 59.1 | 8.7 | 3.8 | 61.8 | 9.0 |
| Orange peel and pulp (dried), Min | 8.0 | 1.5 | 10.0 | 65.0 | 11.5 | 4.0 | 33.4 | 4.8 |
| Peanut meal, 43% protein, Av | 43.0 | 7.8 | 6.2 | 30.7 | 5.0 | 7.3 | 78.6 | 34.5 |
| Peanut meal or cake, 43% protein, Min | 43.0 | 6.0 | 15.0 | 23.0 | 7.5 | 5.5 | 68.0 | 34.5 |
| Peanut meal, fat not extracted, Av | 32.0 | 48.7 | 2.4 | 9.5 | 5.1 | 2.3 | 133.0 | 25.7 |
| Peanut meats, Min | 30.0 | 45.0 | 2.5 | 10.0 | 10.0 | 2.5 | 124.7 | 24.1 |
| Peanut vines without nuts, Min | 10.0 | 3.5 | 24.0 | 44.0 | 9.5 | 9.0 | 34.4 | 8.2 |
| Peas, Av | 22.8 | 1.1 | 5.7 | 57.8 | 9.2 | 3.4 | 76.4 | 20.1 |
| Peas, Canadian, Min | 24.0 | 1.2 | 5.0 | 55.0 | 10.0 | 4.8 | 75.0 | 21.1 |
| Pepper seed (chili), Av | 17.1 | 25.0 | 30.0 | 18.0 | 6.6 | 3.3 | 28.8 | 10.8 |
| Potatoes, Av | 2.1 | 0.1 | 0.6 | 16.3 | 79.9 | 1.0 | 15.8 | 1.0 |
| Rice bran, Av | 12.8 | 12.5 | 12.1 | 43.4 | 8.6 | 10.6 | 54.0 | 7.4 |
| Rice bran, Min | 11.0 | 10.0 | 15.0 | 42.0 | 12.0 | 10.0 | 47.3 | 6.4 |
| Rice, brown (hull removed), Av | 9.1 | 2.0 | 1.1 | 74.5 | 12.2 | 1.1 | 90.1 | 7.7 |
| Rice, clean, Min | 8.0 | 0.5 | 0.5 | 78.0 | 12.0 | 1.0 | 88.6 | 6.3 |
| Rice, clean and polished, Av | 8.7 | 0.4 | 0.4 | 77.4 | 12.4 | 0.7 | 88.5 | 6.9 |
| Rice, ground rough, Min | 7.0 | 1.8 | 10.0 | 63.0 | 13.2 | 5.0 | 67.7 | 5.2 |
| Rice polish, Av | 12.8 | 11.6 | 3.2 | 58.0 | 8.5 | 5.9 | 94.4 | 10.4 |
| Rice polish, Min | 11.0 | 6.0 | 4.0 | 60.0 | 12.5 | 6.5 | 81.1 | 8.9 |
| Rice, rough or unhulled, Av | 8.1 | 1.8 | 8.9 | 64.5 | 11.7 | 5.0 | 66.9 | 6.0 |
| Rye, Av | 11.1 | 1.7 | 2.1 | 73.7 | 9.5 | 1.9 | 76.5 | 7.3 |
| Rye, Min | 10.0 | 1.5 | 2.0 | 72.0 | 12.5 | 2.0 | 74.0 | 6.5 |
| Sesame cake or meal, Min | 36.0 | 7.0 | 8.0 | 29.0 | 10.0 | 10.0 | 70.3 | 30.0 |
| Shallu, Av | 11.2 | 3.8 | 2.0 | 71.0 | 11.0 | 1.0 | 87.5 | 8.7 |
| Sorghum seed, Min | 9.0 | 2.5 | 3.0 | 69.0 | 14.5 | 2.0 | 71.3 | 1.4 |
| Sorghum seed, Av | 9.8 | 2.9 | 3.2 | 72.4 | 10.2 | 1.5 | 75.3 | 1.6 |
| Sorghum seed, Min | 9.0 | 2.5 | 3.0 | 71.0 | 12.5 | 2.0 | 73.1 | 1.4 |
| Sunflower seed, Min | 16.0 | 21.0 | 30.0 | 21.0 | 9.0 | 3.0 | 70.0 | 9.8 |
| Soybeans, Av | 39.1 | 18.7 | 5.2 | 25.8 | 6.4 | 4.8 | 93.8 | 27.3 |
| Soybean meal, Min | 33.0 | 15.0 | 5.0 | 31.6 | 10.0 | 5.4 | 87.7 | 27.5 |
| Soybean oil meal, Av | 4.70 | 7.8 | 5.7 | 27.7 | 6.2 | 5.6 | 80.2 | 39.2 |
| Sunflower seed, Av | 15.9 | 24.0 | 28.6 | 21.1 | 6.2 | 4.2 | 28.7 | 10.1 |

Table 7.—Average composition and minimum guarantee for Texas and productive values of poultry feeds—(continued).

| | Protein | Ether Extract | Crude Fiber | Nitrogen-free Extract | Water | Ash | Productive Energy | Digestible Protein |
|---|---|---|---|---|---|---|---|---|
| Tankage, digester, Av. | 63.0 | 8.0 | 1.5 | 2.8 | 8.7 | 16.0 | 73.4 | 53.7 |
| Tankage, digester, Min. | 60.0 | 5.0 | 3.0 | 0 | 14.0 | 18.0 | 62.9 | 51.2 |
| Tankage, 60% protein, Min. | 60.0 | 8.0 | 3.0 | 4.0 | 10.0 | 15.0 | 71.3 | 51.2 |
| Wheat, Av. | 12.3 | 1.8 | 2.4 | 71.1 | 10.6 | 1.8 | 78.9 | 9.1 |
| Wheat, Min. | 12.0 | 2.0 | 3.0 | 70.0 | 11.0 | 2.0 | 77.8 | 8.9 |
| Wheat bran, Av. | 16.8 | 4.3 | 9.4 | 53.5 | 9.7 | 6.3 | 38.5 | 10.1 |
| Wheat bran, Min. | 14.5 | 3.0 | 10.0 | 54.0 | 13.0 | 5.5 | 36.4 | 8.7 |
| Wheat brown shorts, Av. | 18.5 | 4.8 | 6.3 | 55.5 | 10.3 | 4.6 | 38.5 | 9.3 |
| Wheat brown shorts, Min. | 17.5 | 4.0 | 7.5 | 53.0 | 13.5 | 4.5 | 38.2 | 10.5 |
| Wheat flour (low grade), Min. | 14.0 | 1.5 | 2.0 | 70.0 | 10.5 | 2.0 | 78.8 | 10.4 |
| Wheat gray shorts, Min. | 17.0 | 4.0 | 6.0 | 60.0 | 9.0 | 4.0 | 59.5 | 11.8 |
| Wheat gray shorts, Av. | 18.0 | 4.5 | 5.8 | 57.0 | 10.4 | 4.3 | 59.0 | 12.5 |
| Wheat mixed feed, Av. | 17.5 | 4.1 | 7.5 | 55.5 | 10.5 | 4.9 | 37.4 | 8.8 |
| Wheat mixed feed, Min. | 16.0 | 3.5 | 8.5 | 54.0 | 12.5 | 5.5 | 44.0 | 12.2 |
| Wheat white shorts or red dog, Min. | 14.5 | 3.0 | 3.5 | 65.0 | 11.0 | 3.0 | 76.0 | 10.7 |
| Wheat white shorts or red dog, Av. | 16.5 | 3.1 | 2.9 | 64.3 | 10.3 | 2.9 | 76.9 | 12.2 |

The minimum guarantees used by the Feed Control Service are also given in the tables, and the productive energy, and digestible protein calculated for them. In some cases, the nitrogen-free extract is made a little higher than the minimum guarantee, in order to avoid assuming too high content of water and to come nearer giving the correct productive energy. Commercial feeds made by the manufacturers are frequently sold with the minimum guarantee given in this table. The composition of mixed feeds is calculated from the percentage of the ingredients and their minimum guarantee.

## CALCULATION OF COMPOSITION AND FEEDING VALUES OF MIXED FEEDS FOR POULTRY

The guaranteed composition of mixed poultry feeds is usually calculated from the minimum guarantee of the ingredients. The actual composition of the mixture should be somewhat above this calculated composition, for all the ingredients should not be of the minimum composition at the same time. The minimum composition given in Table 7 may be used for such calculations, though the nitrogen-free extract in some of these is a little above the minimum guarantee, as previously explained.

The digestible protein and productive energy may be calculated in the same way from the values given in Table 7. This would give an approximate idea of the feeding value of the mixture.

The calculation is very simple. The percentage of each material used in the feed (such as corn, milo, etc.) is multiplied by its percentage content of protein, crude fiber, fat, digestible protein, or productive energy, etc., expressed decimally, and the products totaled.

Table 8.—Digestion coefficients of poultry feeds

| | Protein | Ether Extract | Crude Fiber | Nitrogen-free Extract | Reference Number |
|---|---|---|---|---|---|
| Alfalfa leaf meal, Texas | 99.7 | 0 | 0 | 0 | 105 |
| Alfalfa leaf meal, Texas | 100.0 | 0 | 6.9 | 0 | 105 |
| Average (2) | 99.7 | 0 | 3.5 | 0 | |
| Alfalfa meal, Texas | 77.9 | 29.3 | 0 | 31.9 | 58 |
| Alfalfa meal, Texas | 48.8 | 14.3 | 2.8 | 36.9 | 58 |
| Average (2) | 63.4 | 21.8 | 1.4 | 34.4 | |
| Barley (whole), Russia | 73.7 | 64.7 | 0 | 87.9 | 1 F |
| Barley (whole), Russia | 84.8 | 71.8 | 0 | 90.5 | 1 F |
| Barley (whole), Germany | 75.4 | 67.4 | 0.2 | 81.1 | 7 F |
| Barley (whole), Japan-C | 75.6 | 57.6 | 0 | 80.1 | 18 F |
| Barley (whole), Japan-C | 76.0 | 63.0 | 0 | 80.5 | 18 F |
| Barley (whole), Japan-C | 76.0 | 49.2 | 0 | 81.3 | 18 F |
| Barley (whole), Japan-C | 76.6 | 60.7 | 0 | 81.6 | 18 F |
| Barley (whole), Japan-C | 73.4 | 46.9 | 0 | 80.3 | 19 F |
| Barley (whole), Japan-C | 76.8 | 50.8 | 0 | 79.4 | 19 F |
| Barley (whole), Japan-O | 72.7 | 36.1 | 4.0 | 86.0 | 20 F |
| Barley (whole), Japan-O | 74.8 | 33.3 | 1.0 | 84.5 | 20 F |
| Barley, North Carolina | 75.4 | 66.8 | 4.7 | 83.1 | 48 |
| Barley, North Carolina | 70.1 | 61.9 | 4.0 | 79.9 | 48 |
| Barley, Texas | 74.6 | 52.4 | 38.1 | 74.5 | 67 |
| Barley, Texas | 76.5 | 57.6 | 48.7 | 78.8 | 67 |
| Barley, Texas | 73.0 | 50.6 | 23.8 | 83.0 | 75 |
| Barley, Texas | 64.3 | 67.1 | 24.1 | 82.9 | 75 |
| Barley, Texas | 58.7 | 76.9 | 20.1 | 83.1 | 82 |
| Barley, Texas | 40.1 | 73.4 | 9.6 | 83.5 | 82 |
| Barley, Texas | 67.8 | 62.0 | 16.2 | 81.5 | 101 |
| Barley, Texas | 75.8 | 50.8 | 31.9 | 81.4 | 101 |
| Average (21) | 72.0 | 58.1 | 10.4 | 82.1 | |
| Bran, corn meal, gluten feed, beef scraps, Maine | 80.9 | 73.8 | 0 | 43.3 | 15 |
| Bran, corn meal, gluten feed, beef scraps, Maine | 76.4 | 69.9 | 0 | 65.3 | 15 |
| Bran, corn meal, gluten feed, beef scraps, Maine | 75.6 | 67.1 | 0 | 44.9 | 15 |
| Bran, corn meal, gluten feed, beef scraps, Maine | 81.0 | 83.0 | 0 | 53.6 | 15 |
| Bran, corn meal, gluten feed, beef scraps, Maine | 84.0 | 79.9 | 0 | 50.0 | 15 |
| Average (5) | 78.6 | 74.7 | ..... | 51.4 | |
| Bran, corn meal, linseed meal, beef scraps, Maine | 75.0 | 73.2 | 0 | 47.3 | 16 |
| Bran, corn meal, linseed meal, beef scraps, Maine | 76.2 | 81.1 | 0 | 47.5 | 16 |
| Bran, corn meal, linseed meal, beef scraps, Maine | 74.6 | 81.1 | 0 | 45.2 | 16 |
| Average (3) | 75.3 | 78.5 | 0 | 46.7 | |
| Bran, corn meal, linseed meal, gluten feed, Maine | 70.1 | 71.5 | 0 | 32.6 | 17 |
| Bran, corn meal, linseed meal, gluten feed, Maine | 79.8 | 73.3 | 0 | 39.9 | 17 |
| Bran, corn meal, linseed meal, gluten feed, Maine | 77.7 | 61.3 | 0 | 40.9 | 17 |
| Bran, corn meal, linseed meal, gluten feed, Maine | 81.5 | 66.6 | 0 | 41.9 | 18 |
| Bran, corn meal, linseed meal, gluten feed, Maine | 78.7 | 75.7 | 0 | 38.7 | 18 |
| Bran, corn meal, linseed meal, gluten feed, Maine | 75.8 | 64.1 | 0 | 43.7 | 18 |
| Average (6) | 77.3 | 68.8 | ..... | 39.6 | |

Table 8.—Digestion coefficients of poultry feeds—(continued).

| | Protein | Ether Extract | Crude Fiber | Nitrogen-free Extract | Reference Number |
|---|---|---|---|---|---|
| Blood meal, North Carolina | 89.3 | 79.2 | 0 | 71.3 | 36 |
| Blood meal, North Carolina | 90.2 | 17.3 | 0 | 73.1 | 36 |
| Blood meal, North Carolina | 87.6 | 80.5 | 0 | 70.2 | 36 |
| Blood meal, North Carolina | 85.3 | 76.5 | 0 | 71.6 | 36 |
| Blood meal, Texas | 96.2 | 16.0 | 34.9 | 0 | 89 |
| Blood meal, Texas | 100.0 | 8.4 | 0 | 0 | 89 |
| Average (6) | 91.4 | 46.3 | 17.5 | 47.7 | |
| Buckwheat, Russia | 52.9 | 93.5 | 1.1 | 87.5 | 4 F |
| Buckwheat, Russia | 65.9 | 84.9 | 3.0 | 86.5 | 4 F |
| Buckwheat, North Carolina | 56.2 | 86.2 | 6.8 | 83.2 | 45 |
| Buckwheat, North Carolina | 55.1 | 85.0 | 7.1 | 81.1 | 45 |
| Buckwheat, North Carolina | 55.5 | 84.2 | 6.7 | 81.0 | 45 |
| Buckwheat, North Carolina | 57.1 | 83.0 | 6.1 | 79.8 | 45 |
| Buckwheat, North Carolina | 56.4 | 82.2 | 6.0 | 82.1 | 45 A |
| Buckwheat, North Carolina | 55.4 | 81.5 | 5.1 | 80.4 | 45 A |
| Buckwheat, whole, Texas | 77.7 | 91.1 | 8.1 | 86.9 | 68 |
| Buckwheat, whole, Texas | 74.4 | 87.4 | 9.8 | 87.0 | 68 |
| Buckwheat, Japanese, Texas | 53.3 | 85.9 | 30.5 | 88.1 | 85 |
| Buckwheat, Japanese, Texas | 74.0 | 90.8 | 30.7 | 83.0 | 85 |
| Average (12) | 61.2 | 86.3 | 10.1 | 83.9 | |
| Buttermilk, dried, North Carolina | 78.2 | 79.1 | 0 | 83.1 | 37 |
| Buttermilk, dried, North Carolina | 80.2 | 77.2 | 0 | 81.6 | 37 |
| Buttermilk, dried, North Carolina | 81.7 | 80.5 | 0 | 82.2 | 37 |
| Buttermilk, dried, North Carolina | 83.0 | 76.2 | 0 | 80.0 | 37 |
| Buttermilk, dried, North Carolina | 84.7 | 80.1 | 0 | 78.8 | 37 A |
| Average (5) | 81.6 | 78.6 | ..... | 81.1 | |
| Clover and corn meal, Maine | 69.4 | 66.0 | 8.5 | 61.3 | 6 |
| Clover and corn meal, Maine | 69.0 | 66.1 | 7.2 | 61.9 | 6 |
| Clover and corn meal, Maine | 77.1 | 68.8 | 15.5 | 61.7 | 6 |
| Average (3) | 71.8 | 66.7 | 10.4 | 61.6 | |
| Corn, Paraschtscuk,-O | 93.2 | 82.1 | 20.0 | 90.5 | 8 F |
| Corn, Paraschtscuk,-O | 93.9 | 83.4 | 27.7 | 94.1 | 8 F |
| Corn, Paraschtscuk,-O | 95.6 | 84.2 | 35.7 | 92.1 | 8 F |
| Corn, Paraschtscuk,-O | 87.3 | 84.0 | 41.4 | 90.4 | 8 F |
| Corn, North Carolina | 72.2 | 85.2 | 5.6 | 89.5 | 30 |
| Corn, North Carolina | 66.5 | 80.0 | 6.1 | 89.5 | 30 |
| Corn, North Carolina | 62.6 | 74.8 | 5.4 | 86.6 | 30 |
| Corn, North Carolina | 66.1 | 69.4 | 6.3 | 91.6 | 30 |
| Corn chops, North Carolina | 71.7 | 67.0 | 6.0 | 89.8 | 30 A |
| Corn, Texas | 65.6 | 93.4 | 35.1 | 88.4 | 52 |
| Corn, Texas | 65.0 | 88.2 | 5.8 | 90.2 | 52 |
| Corn, Maine | 68.3 | 87.0 | 0 | 91.6 | 2 |
| Corn, U. S. D. A | 83.4 | 85.8 | 17.0 | 89.9 | 27 |
| Corn, U. S. D. A | 86.6 | 86.6 | 20.2 | 88.2 | 27 |
| Corn, U. S. D. A | 80.3 | 86.0 | 24.7 | 88.3 | 27 |
| Corn, U. S. D. A | 82.1 | 81.1 | .7 | 90.8 | 27 |
| Corn, U. S. D. A | 87.4 | 87.2 | 10.0 | 89.2 | 27 A |
| Corn, Oklahoma | 47.5 | 88.3 | 0 | 89.9 | 21 |
| Corn, Oklahoma | 57.6 | 95.2 | 0 | 95.7 | 21 |
| Corn, Oklahoma | 44.4 | 91.7 | 0 | 91.8 | 21 |
| Corn chops, Mexican, Texas | 90.1 | 93.8 | 40.6 | 89.8 | 56 |
| Corn chops, Mexican, Texas | 85.8 | 93.5 | 47.5 | 91.1 | 56 |
| Corn, cracked, Maine | 71.9 | 86.7 | 0 | 86.9 | 3 |
| Corn, cracked, Maine | 72.5 | 87.6 | 0 | 87.6 | 3 |
| Average (24) | 74.9 | 85.1 | 14.8 | 90.1 | |
| Corn meal, Maine | 72.0 | 88.3 | 0 | 84.0 | 4 |
| Corn meal, Maine | 77.1 | 86.9 | 0 | 87.9 | 4 |
| Corn meal, Texas | 89.3 | 95.8 | 59.8 | 96.2 | 57 |
| Corn meal, Texas | 87.3 | 95.5 | 55.9 | 95.9 | 57 |
| Corn meal, Texas | 84.7 | 91.4 | 11.7 | 92.9 | 87 |
| Corn meal, Texas | 59.8 | 92.1 | 10.7 | 96.3 | 87 |
| Corn meal, Texas | 87.9 | 91.0 | 27.7 | 91.2 | 100 |
| Corn meal, Texas | 86.2 | 88.6 | 1.2 | 92.1 | 100 |

Table 8.—Digestion coefficients of poultry feeds—(continued).

| | Protein | Ether Extract | Crude Fiber | Nitrogen-free Extract | Reference Number |
|---|---|---|---|---|---|
| Corn meal, Oklahoma | 49.7 | 94.1 | 0 | 92.1 | 22 |
| Corn meal, Oklahoma | 54.6 | 92.2 | 0 | 91.1 | 22 |
| Corn meal, Oklahoma | 40.9 | 92.2 | 0 | 91.2 | 22 |
| Average (11) | 71.8 | 91.6 | 15.2 | 91.9 | |
| Corn meal (bolted), North Carolina | 73.9 | 87.4 | 2.0 | 86.5 | 33 |
| Corn meal (bolted), North Carolina | 72.4 | 86.2 | 4.2 | 87.7 | 33 |
| Corn meal (bolted), North Carolina | 74.3 | 86.0 | 13.6 | 90.5 | 33 |
| Corn meal (bolted), North Carolina | 76.1 | 86.9 | 4.0 | 87.1 | 33 |
| Corn meal (bolted), North Carolina | 73.5 | 84.9 | 0 | 89.2 | 33 A |
| Average (5) | 74.0 | 86.3 | 4.8 | 88.2 | |
| Corn meal (unbolted), North Carolina | 73.6 | 85.2 | 7.0 | 87.9 | 41 |
| Corn meal (unbolted), North Carolina | 72.9 | 84.7 | 6.9 | 88.1 | 41 |
| Corn meal (unbolted), North Carolina | 73.9 | 83.6 | 6.5 | 87.0 | 41 |
| Average (3) | 73.5 | 84.5 | 6.8 | 87.7 | |
| Corn and corn meal, bolted and unbolted, average (43) | 73.6 | 86.9 | 13.2 | 90.2 | |
| Corn meal 7 parts, beef scraps 1 part, Maine | 79.9 | 10.0 | 0 | 90.4 | 10 |
| Corn meal 7 parts, beef scraps 1 part, Maine | 70.9 | 87.5 | 0 | 86.8 | 10 |
| Corn meal 7 parts, beef scraps 1 part, Maine | 85.7 | 93.4 | 0 | 96.3 | 10 |
| Corn meal 7 parts, beef scraps 1 part, Maine | 87.8 | 86.7 | 0 | 91.6 | 10 |
| Corn meal 7 parts, beef scraps 1 part, Maine | 87.4 | 91.7 | 0 | 93.2 | 10 |
| Average (5) | 82.3 | 73.9 | ..... | 91.7 | |
| Corn meal and beef scraps, Maine | 89.0 | 93.8 | 0 | 77.3 | 7 |
| Corn meal and beef scraps, Maine | 90.9 | 95.1 | 0 | 77.4 | 7 |
| Average (2) | 90.0 | 94.5 | ..... | 77.4 | |
| Cottonseed meal, North Carolina | 81.1 | 78.0 | 6.3 | 79.6 | 41 |
| Cottonseed meal, North Carolina | 80.2 | 70.2 | 5.1 | 89.3 | 41 |
| Cottonseed meal, North Carolina | 84.3 | 80.1 | 5.6 | 83.2 | 41 |
| Cottonseed meal, North Carolina | 82.1 | 79.0 | 5.0 | 79.8 | 41 |
| Cottonseed meal, Texas | 62.2 | 92.9 | 20.1 | 79.9 | 60 |
| Cottonseed meal, Texas | 53.3 | 89.7 | 0 | 86.3 | 60 |
| Cottonseed meal, Texas | 86.9 | 100.0 | 22.0 | 89.3 | 88 |
| Cottonseed meal, Texas | 78.5 | 100.0 | 31.3 | 98.0 | 88 |
| Average (8) | 76.1 | 86.2 | 11.9 | 85.7 | |
| Cowpeas, Oklahoma | 32.1 | 87.5 | 10.0 | 88.3 | 23 |
| Cowpeas, Oklahoma | 47.9 | 88.9 | 42.9 | 86.0 | 23 |
| Cowpeas, Oklahoma | 41.5 | 89.6 | 2.2 | 86.9 | 23 |
| Cowpea meal, Oklahoma | 48.8 | 92.6 | 9.9 | 84.0 | 24 |
| Cowpea meal, Oklahoma | 42.1 | 98.4 | 11.3 | 88.5 | 24 |
| Cowpea meal, Oklahoma | 40.1 | 75.0 | 7.6 | 90.8 | 24 |
| Cowpea meal, Texas | 69.6 | 84.9 | 1.9 | 81.8 | 94 |
| Cowpea meal, Texas | 64.8 | 86.2 | 1.0 | 82.9 | 94 |
| Average (8) | 48.4 | 87.9 | 10.9 | 86.2 | |
| Darso, Texas | 39.1 | 86.7 | 35.4 | 88.6 | 78 |
| Darso, Texas | 25.2 | 87.3 | 44.0 | 91.5 | 78 |
| Darso, Texas | 30.7 | 88.4 | 17.1 | 89.4 | 109 |
| Darso, Texas | 33.6 | 72.5 | 0 | 85.9 | 109 |
| Darso, Texas | 36.3 | 89.6 | 65.1 | 91.9 | 55 |
| Darso, Texas | 45.3 | 89.1 | 64.5 | 85.9 | 55 |
| Average (6) | 36.0 | 85.6 | 37.7 | 88.9 | |
| Feterita (Spur), Texas | 77.7 | 84.7 | 50.6 | 93.6 | 54 |
| Feterita (Spur), Texas | 85.0 | 81.9 | 37.3 | 91.5 | 54 |
| Feterita (Spur), Texas | 84.6 | 82.1 | 50.7 | 93.1 | 71 |
| Feterita (Spur), Texas | 92.9 | 81.2 | 17.4 | 89.6 | 71 |

Table 8.—Digestion coefficients of poultry feeds—(continued).

| | Protein | Ether Extract | Crude Fiber | Nitrogen-free Extract | Reference Number |
|---|---|---|---|---|---|
| Feterita (Spur), Texas | 93.5 | 85.8 | 37.6 | 90.9 | 79 |
| Feterita (Spur), Texas | 90.2 | 82.4 | 32.1 | 90.7 | 79 |
| Feterita (Spur), Texas | 82.4 | 79.5 | 28.9 | 97.8 | 108 |
| Feterita (Spur), Texas | 93.6 | 71.0 | 27.1 | 88.8 | 108 |
| Feterita (Spur), Texas | 89.2 | 75.5 | 45.2 | 85.5 | 110 |
| Feterita (Spur), Texas | 88.9 | 82.5 | 5.1 | 91.0 | 110 |
| Average (10) | 87.8 | 80.7 | 33.2 | 91.3 | |
| Fish scraps, Japan O | 95.0 | 99.3 | 0 | 58.2 | 30 F |
| Fish scraps, Japan O | 91.9 | 99.0 | 0 | 0 | 30 F |
| Fish scraps, Japan O | 87.8 | 95.7 | 0 | 18.8 | 31 F |
| Fish scraps, Japan O | 90.9 | 99.7 | 0 | 0 | 31 F |
| Dried fish, Japan C | 84.0 | 98.1 | 0 | 0 | 32 F |
| Dried fish, Japan C | 90.8 | 100.0 | 0 | 0 | 32 F |
| Fish meal, North Carolina | 91.5 | 92.3 | 0 | 0 | 40 |
| Fish meal, North Carolina | 92.2 | 92.0 | 0 | 0 | 40 |
| Fish meal, North Carolina | 90.9 | 93.0 | 0 | 0 | 40 |
| Fish meal, North Carolina | 91.7 | 91.1 | 0 | 0 | 40 |
| Fish meal, North Carolina | 91.1 | 92.7 | 0 | 0 | 40 A |
| Average (11) | 90.7 | 95.7 | ..... | 15.4 | |
| Getrocknete Gemuse, Japan C | 84.3 | 44.1 | 0 | 62.3 | 17 F |
| Getrocknete Gemuse, Japan C | 79.5 | 10.0 | 0 | 76.2 | 17 F |
| Average (2) | 81.9 | 27.1 | 0 | 69.3 | |
| India wheat, Maine | 74.9 | 78.8 | 5.0 | 79.3 | 9 |
| India wheat, Maine | 79.5 | 86.6 | 29.1 | 85.5 | 9 |
| India wheat, Maine | 70.6 | 85.9 | 28.6 | 85.4 | 9 |
| Average (3) | 75.0 | 83.8 | 20.9 | 83.4 | |
| Kafir (grain or meal), North Carolina | 68.4 | 83.7 | 4.2 | 87.6 | 47 |
| Kafir (grain or meal), North Carolina | 70.2 | 72.9 | 5.1 | 83.8 | 47 |
| Kafir (grain or meal), North Carolina | 67.2 | 71.9 | 4.8 | 81.6 | 47 |
| Kafir (grain or meal), North Carolina | 68.3 | 70.2 | 4.0 | 80.1 | 47 |
| Kafir (grain or meal), North Carolina | 69.5 | 79.9 | 4.2 | 0 | 47 A |
| Kafir (whole grain), Oklahoma | 50.4 | 73.9 | 17.3 | 97.9 | 19 |
| Kafir (whole grain), Oklahoma | 55.3 | 71.2 | 21.8 | 93.8 | 19 |
| Kafir (whole grain), Oklahoma | 53.0 | 75.9 | 21.1 | 97.1 | 19 |
| Kafir meal, Oklahoma | 41.8 | 81.8 | 29.7 | 97.5 | 20 |
| Kafir meal, Oklahoma | 42.3 | 84.1 | 35.1 | 95.0 | 20 |
| Kafir meal, Oklahoma | 43.6 | 82.1 | 41.7 | 97.1 | 20 |
| Kafir (dwarf), Texas | 96.4 | 84.9 | 40.7 | 93.3 | 70 |
| Kafir (dwarf), Texas | 91.8 | 81.5 | 20.3 | 93.2 | 70 |
| Kafir (dwarf), Texas | 86.3 | 84.1 | 5.7 | 93.3 | 77 |
| Kafir (dwarf), Texas | 78.3 | 85.2 | 20.1 | 94.1 | 77 |
| Kafir (dwarf), Texas | 59.3 | 76.6 | 29.7 | 90.6 | 112 |
| Kafir (dwarf), Texas | 92.7 | 67.4 | 0 | 90.5 | 112 |
| Average (17) | 66.8 | 78.1 | 18.0 | 91.7 | |
| Average for Texas only (6) | 84.1 | 80.0 | 19.4 | 92.5 | |
| Meat meal, meat and bone meal, Maine | 92.6 | 95.6 | 0 | 0 | 8 |
| Meat meal, meat and bone meal, U. S. D. A | 90.5 | 86.0 | 0 | 0 | 25 |
| Meat meal, meat and bone meal, U. S. D. A. | 89.9 | 86.9 | 0 | 0 | 25 |
| Bone meal, North Carolina | 91.9 | 94.3 | 3.5 | 76.0 | 34 |
| Bone meal, North Carolina | 92.5 | 92.0 | 3.0 | 77.1 | 34 |
| Bone meal, Texas | 66.5 | 100.0 | 61.8 | 84.9 | 90 |
| Bone meal, Texas | 83.1 | 97.0 | 100.0 | 0 | 90 |
| Average (7) | 86.7 | 93.1 | 24.0 | 34.0 | |
| Millet, Texas | 75.1 | 73.9 | 14.2 | 87.5 | 83 |
| Millet, Texas | 77.0 | 81.9 | 19.5 | 86.4 | 83 |
| Average (2) | 76.1 | 77.9 | 16.9 | 87.0 | |

Table 8.—Digestion coefficients of poultry feeds—(continued).

| | Protein | Ether Extract | Crude Fiber | Nitrogen-free Extract | Reference Number |
|---|---|---|---|---|---|
| Milo (dwarf yellow), Texas | 80.4 | 86.4 | 45.8 | 95.0 | 53 |
| Milo (dwarf yellow), Texas | 71.6 | 82.8 | 0 | 96.0 | 53 |
| Milo (dwarf yellow), Texas | 80.7 | 83.4 | 26.3 | 94.4 | 73 |
| Milo (dwarf yellow), Texas | 83.7 | 85.7 | 0 | 83.0 | 73 |
| Milo (dwarf yellow), Texas | 82.8 | 85.6 | 41.9 | 91.7 | 91 |
| Milo (dwarf yellow), Texas | 100.0 | 79.1 | 34.3 | 84.0 | 111 |
| Milo (dwarf yellow), Texas | 89.7 | 84.0 | 49.0 | 93.1 | 81 |
| Milo (dwarf yellow), Texas | 82.3 | 83.6 | 37.1 | 92.7 | 81 |
| Milo (dwarf yellow), Texas | 66.5 | 75.6 | 65.0 | 95.6 | 98 |
| Milo (dwarf yellow), Texas | 78.5 | 55.4 | 5.3 | 91.1 | 98 |
| Milo (dwarf yellow), Texas | 92.3 | 79.9 | 29.4 | 90.9 | 104 |
| Milo (dwarf yellow), Texas | 91.2 | 48.7 | 40.5 | 90.0 | 104 |
| Average (12) | 83.3 | 77.5 | 31.2 | 91.5 | |
| Oat groats, Texas | 88.2 | 93.3 | 68.7 | 97.0 | 51 |
| Oat groats, Texas | 85.7 | 91.1 | 56.1 | 95.6 | 51 |
| Oat groats, North Carolina | 72.1 | 86.8 | 5.2 | 89.7 | 44 |
| Oat groats, North Carolina | 70.9 | 87.5 | 5.0 | 89.0 | 44 |
| Oat groats, North Carolina | 69.1 | 85.0 | 4.4 | 87.5 | 44 |
| Oat groats, North Carolina | 68.3 | 82.3 | 5.2 | 83.2 | 44 |
| Oat groats, North Carolina | 68.7 | 81.4 | 5.0 | 81.8 | 44 A |
| Oat groats, Maine | 81.0 | 86.2 | 0 | 84.8 | 12 |
| Oat groats, Maine | 77.9 | 100.0 | 0 | 86.8 | 12 |
| Oat groats, Maine | 70.9 | 91.8 | 0 | 100.0 | 12 |
| Oat groats, Maine | 90.5 | 89.0 | 0 | 100.0 | 12 |
| Average (11) | 76.7 | 88.6 | 13.6 | 90.5 | |
| Oats, whole, Germany | 62.3 | 84.0 | 0.5 | 60.8 | 5 F |
| Oats, whole, Maine | 78.1 | 82.2 | 1.5 | 66.0 | 11 |
| Oats, whole, Maine | 78.5 | 89.3 | 0 | 65.6 | 11 |
| Oats, whole, Maine | 72.3 | 84.5 | 1.9 | 63.1 | 11 |
| Oats, whole, Maine | 83.7 | 87.0 | 0 | 61.8 | 11 |
| Oats, whole, U. S. D. A. | 72.5 | 82.0 | 11.2 | 67.3 | 28 |
| Oats, whole, U. S. D. A. | 77.4 | 82.3 | 6.5 | 70.0 | 28 |
| Oats, whole, U. S. D. A. | 74.2 | 79.5 | 9.8 | 74.8 | 28 |
| Oats, whole, U. S. D. A. | 70.8 | 77.2 | 10.6 | 65.2 | 28 |
| Oats, whole, U. S. D. A. | 80.5 | 85.4 | 8.8 | 73.2 | 28 A |
| Oats, whole, U. S. D. A. | 72.7 | 83.4 | 4.3 | 71.0 | 28 A |
| Oats, whole, U. S. D. A. | 67.8 | 81.4 | 5.0 | 71.9 | 28 A |
| Oats, whole, North Carolina | 69.7 | 70.4 | 19.8 | 68.4 | 32 |
| Oats, whole, North Carolina | 68.8 | 75.1 | 13.2 | 74.2 | 32 |
| Oats, whole, North Carolina | 74.2 | 76.5 | 6.9 | 75.4 | 32 |
| Oats, whole, North Carolina | 77.8 | 76.2 | 13.1 | 71.4 | 32 |
| Oats, whole, North Carolina | 75.1 | 74.7 | 7.4 | 69.5 | 32 A |
| Oats, whole, North Carolina | 75.4 | 73.5 | 9.8 | 72.0 | 32 A |
| Oats, whole, Texas | 71.1 | 89.1 | 19.0 | 70.9 | 50 |
| Oats, whole, Texas | 72.4 | 89.8 | 0 | 72.6 | 106 |
| Oats, whole, Texas | 79.8 | 91.2 | 0 | 70.0 | 106 |
| Average (21) | 74.1 | 81.7 | 7.1 | 69.3 | |
| Peanut meats, North Carolina | 79.2 | 80.2 | 4.4 | 83.2 | 39 |
| Peanut meats, North Carolina | 81.4 | 78.2 | 5.0 | 83.3 | 39 |
| Peanut meats, North Carolina | 77.6 | 76.4 | 4.0 | 86.1 | 39 |
| Peanut meats, North Carolina | 80.2 | 77.0 | 4.9 | 85.2 | 39 |
| Peanut meats, North Carolina | 83.1 | 80.3 | 2.2 | 83.0 | 39 A |
| Average (5) | 80.3 | 78.4 | 4.1 | 84.2 | |
| Peas, Kalugin | 91.0 | 91.2 | 12.2 | 95.0 | 3 F |
| Peas | 89.7 | 76.1 | 15.3 | 88.3 | 3 F |
| Peas, Lehmann O | 83.6 | 76.3 | 0 | 78.0 | 10 F |
| Average (3) | 88.1 | 81.2 | 9.2 | 87.1 | |
| Peas and cowpeas, average | 59.2 | 86.1 | 10.4 | 86.4 | |

Table 8.—Digestion coefficients of poultry feeds—(continued).

| | Protein | Ether Extract | Crude Fiber | Nitrogen-free Extract | Reference Number |
|---|---|---|---|---|---|
| Potatoes, Voltz O | 46.9 | 0 | 0 | 84.6 | 11 F |
| Potatoes, Germany O | 47.7 | —47.5 | 5.6 | 89.5 | 11 F |
| Potatoes, Germany O | 51.0 | —95.0 | 6.5 | 84.3 | 11 F |
| Potatoes, Germany O | 53.6 | (—127) | 4.8 | 87.1 | 12 F |
| Potatoes, Germany O | 54.0 | (—35) | 7.5 | 77.0 | 12 F |
| Potatoes, Germany O | 38.1 | (—102) | 5.5 | 85.1 | 13 F |
| Potatoes, Germany O | 37.2 | (—117) | 8.5 | 83.8 | 13 F |
| Average (7) | 46.9 | 0 | 6.4 | 84.5 | |
| Potatoes and oats, Germany O | 53.5 | 67.0 | 6.2 | 96.0 | 14 F |
| Potatoes and oats, Germany O | 55.6 | 31.8 | 7.3 | 89.0 | 14 F |
| Average (2) | 54.6 | 49.4 | 6.8 | 92.5 | |
| Potatoes, rye and starch, Germany | 50.9 | —13.2 | 5.8 | 88.3 | |
| Potatoes, rye and starch, Germany | 45.1 | —53.5 | 6.8 | 78.7 | |
| Average (2) | 48.0 | —33.4 | 6.3 | 83.5 | |
| Potatoes, sweet, Japan O | 0 | 5.6 | 12.9 | 80.9 | 28 F |
| Potatoes, sweet, Japan C | 0 | 39.2 | 0 | 73.0 | 29 F |
| Potatoes, sweet, JapanC | 0 | 29.2 | 0 | 78.0 | 29 F |
| Average (3) | 0 | 24.7 | 4.3 | 77.3 | |
| Rice bran, Japan O | 71.1 | 88.4 | 0 | 63.7 | 26 F |
| Rice bran, Japan C | 61.0 | 84.6 | 0 | 54.8 | 27 F |
| Rice bran, Japan C | 68.5 | 90.2 | 0 | 56.0 | 27 F |
| Rice bran, Texas | 63.3 | 88.5 | 9.7 | 63.1 | 64 |
| Rice bran, Texas | 54.2 | 89.7 | 17.1 | 62.7 | 64 |
| Rice bran, Texas | 26.6 | 89.1 | 0 | 47.7 | 95 |
| Rice bran, Texas | 57.5 | 86.4 | 0 | 42.8 | 95 |
| Rice bran, Texas | 55.0 | 83.9 | 0 | 41.5 | 102 |
| Rice bran, Texas | 63.5 | 83.0 | 0 | 38.8 | 102 |
| Average (9) | 57.9 | 87.1 | 3.0 | 52.3 | |
| Rice (brown), Texas | 85.0 | 88.0 | 9.7 | 97.9 | 69 |
| Rice (brown), Texas | 83.1 | 87.8 | 3.2 | 98.2 | 69 |
| Average (2) | 84.1 | 87.9 | 6.5 | 98.1 | |
| Brown rice and clover, Japan | 78.4 | 23.4 | 5.6 | 90.5 | |
| Brown rice and clover hay, Japan C | 77.4 | 45.2 | 0 | 88.5 | |
| Brown rice and clover hay, Japan C | 77.6 | 47.8 | 0 | 87.8 | 23 F |
| Average (3) | 77.8 | 38.8 | 5.6 | 88.9 | |
| Rice polish, Texas | 79.9 | 95.1 | 0 | 92.8 | 65 |
| Rice polish, Texas | 71.0 | 96.1 | 13.5 | 94.5 | 65 |
| Rice polish, Texas | 93.8 | 94.7 | 2.3 | 82.9 | 96 |
| Rice polish, Texas | 79.0 | 93.4 | 1.3 | 87.0 | 96 |
| Average (4) | 80.9 | 94.8 | 4.3 | 89.3 | |
| Rice polish, Texas | 76.5 | 4.3 | 0 | 97.4 | 63 |
| Rice polish, Texas | 81.7 | 4.8 | 66.1 | 99.1 | 63 |
| Average (2) | 79.1 | 4.6 | 33.1 | 98.3 | |
| Rice, rough, Japan C | 79.2 | 64.0 | 0 | 88.2 | 21 F |
| Rice, rough, Japan C | 78.0 | 70.8 | 0 | 88.5 | 21 F |
| Rice, rough, Japan O | 73.5 | 5.8 | 4.6 | 88.0 | 22 F |
| Rice, rough, North Carolina | 79.4 | 81.6 | 5.8 | 81.2 | 46 |
| Rice, rough, North Carolina | 73.2 | 78.5 | 6.1 | 80.3 | 46 |
| Rice, rough, North Carolina | 71.7 | 80.2 | 6.0 | 79.2 | 46 |
| Rice, rough, North Carolina | 70.1 | 81.0 | 5.5 | 76.3 | 46 |
| Rice, rough, North Carolina | 71.0 | 79.3 | 5.9 | 77.8 | 46a |
| Rice, rough, Texas | 68.1 | 90.8 | 4.8 | 91.8 | 61 |
| Rice, rough, Texas | 78.1 | 89.5 | 12.6 | 86.5 | 61 |
| Average (10) | 74.2 | 72.2 | 5.1 | 83.8 | |

Table 8.—Digestion coefficients of poultry feeds—(continued).

| | Protein | Ether Extract | Crude Fiber | Nitrogen-free Extract | Reference Number |
|---|---|---|---|---|---|
| Rye, Germany | 70.7 | 16.6 | 2.4 | 87.8 | 6 F |
| Rye, Voltz O | 66.9 | 22.6 | 0 | 86.7 | 15 F |
| Rye, Germany O | 63.0 | 28.5 | 0 | 85.6 | 16 F |
| Rye, North Carolina | 71.5 | 27.8 | 4.6 | 85.2 | 43 |
| Rye, North Carolina | 74.1 | 28.2 | 5.0 | 83.9 | 43 |
| Rye, North Carolina | 69.9 | 27.1 | 4.4 | 81.9 | 43 |
| Rye, Texas | 56.6 | 57.5 | 32.7 | 89.7 | 84 |
| Rye, Texas | 50.0 | 42.7 | 36.0 | 86.8 | 84 |
| Average (8) | 65.3 | 31.4 | 12.2 | 86.0 | |
| Shallu, Texas | 0 | 86.5 | 28.5 | 93.2 | 93 |
| Shallu, Texas | 73.6 | 82.3 | 40.6 | 94.8 | 76 |
| Shallu, Texas | 82.0 | 85.1 | 49.2 | 93.5 | 76 |
| Average (3) | 77.8 | 84.6 | 39.4 | 93.8 | |
| Sorghum seed, Sumac, Texas | 22.0 | 87.2 | .6 | 88.4 | 72 |
| Sorghum seed, Sumac, Texas | 23.4 | 84.4 | 14.5 | 88.6 | 72 |
| Sorghum seed, Sumac, Texas | 24.9 | 86.6 | 20.5 | 91.4 | 80 |
| Sorghum seed, Sumac, Texas | 21.1 | 87.0 | 33.6 | 87.7 | 80 |
| Sorghum seed, Sumac, Texas | 0 | 82.0 | 18.7 | 86.7 | 92 |
| Sorghum seed, Sumac, Texas | 20.5 | 79.8 | 18.5 | 84.1 | 107 |
| Sorghum seed, Sumac, Texas | 0 | ∞1.4 | 0 | 89.0 | 107 |
| Average (7) | 16.0 | 84.1 | 15.2 | 88.0 | |
| Soy bean, Texas | 60.1 | 92.9 | 37.3 | 80.5 | 86 |
| Soy bean, Texas | 79.6 | 93.1 | 67.8 | 72.3 | 86 |
| Average (2) | 69.9 | 93.0 | 52.6 | 76.4 | |
| Soybean oil meal, North Carolina | 85.1 | 79.3 | 2.2 | 83.2 | 38 |
| Soybean oil meal, North Carolina | 83.8 | 81.5 | 2.5 | 81.8 | 38 |
| Soybean oil meal, North Carolina | 82.3 | 82.2 | 2.0 | 83.6 | 38 |
| Soybean oil meal, North Carolina | 84.6 | 81.0 | 2.0 | 82.0 | 38 |
| Soybean oil meal, North Carolina | 80.8 | 83.2 | 2.2 | 85.2 | 38a |
| Average (5) | 83.3 | 81.4 | 2.2 | 83.2 | |
| Soy bean oil cake, Japan-O | 84.9 | 89.0 | 0 | 79.7 | 24 F |
| Soy bean oil cake, Japan-C | 81.3 | 81.2 | 0 | 79.7 | 25 F |
| Soy bean oil cake, Japan-C | 83.9 | 82.1 | 0 | 66.4 | 25 F |
| Average (8) | 83.3 | 82.4 | 0 | 80.2 | |
| Tankage, Texas | 79.5 | 100.0 | 0 | 0 | 66 |
| Tankage, Texas | 80.1 | 100.0 | 0 | 100.0 | 66 |
| Tankage digester, North Carolina | 90.3 | 93.2 | 4.0 | 82.0 | 35 |
| Tankage digester, North Carolina | 91.1 | 90.3 | 3.9 | 81.8 | 35 |
| Average (4) | 85.3 | 95.9 | 4.0 | 43.5 | |
| Tankage and oil meal, average (11) | 86.2 | 94.1 | 19.6 | 45.6 | |
| Wheat middlings 6.25% fiber, North Carolina | 49.3 | 49.5 | 9.1 | 43.9 | 29 |
| Wheat middlings 6.25% fiber, North Carolina | 45.9 | 52.0 | 11.0 | 44.1 | 29 |
| Wheat middlings 6.25% fiber, North Carolina | 45.5 | 52.9 | 9.0 | 45.2 | 29 |
| Wheat middlings 6.25% fiber, North Carolina | 38.7 | 52.2 | 8.2 | 56.0 | 29 |
| Wheat middlings 6.25% fiber, North Carolina | 44.8 | 49.4 | 8.0 | 54.4 | 29a |
| Wheat middlings 6.25% fiber, North Carolina | 44.6 | 45.9 | 10.0 | 48.9 | 29a |
| Wheat middlings 6.25% fiber, North Carolina | 59.9 | 56.9 | 8.2 | 52.1 | 29a |
| Wheat middlings 6.25% fiber, North Carolina | 62.7 | 59.1 | 8.0 | 52.7 | 29a |
| Wheat middlings 6.25% fiber, North Carolina | 58.9 | 55.9 | 9.1 | 49.8 | 29b |
| Average (9) | 50.0 | 52.6 | 9.0 | 49.7 | |
| Wheat gray shorts, Texas | 64.0 | 78.7 | 12.3 | 71.7 | 97 |
| Wheat gray shorts, Texas | 65.0 | 87.1 | 8.6 | 74.3 | 97 |
| Wheat gray shorts, Texas | 80.8 | 89.4 | 20.1 | 65.2 | 103 |
| Wheat gray shorts, Texas | 66.9 | 85.6 | 11.0 | 72.9 | 103 |
| Average (4) | 69.2 | 85.2 | 13.0 | 71.0 | |

Table 8.—Digestion coefficients of poultry feeds—(continued).

| | Protein | Ether Extract | Crude Fiber | Nitrogen-free Extract | Reference Number |
|---|---|---|---|---|---|
| Wheat bran, Japan C | 64.6 | 61.1 | 0 | 60.8 | 33 F |
| Wheat bran, Japan C | 65.9 | 69.8 | 0 | 59.4 | 33 F |
| Wheat bran, Japan O | 63.1 | 49.4 | 9.5 | 67.1 | 34 F |
| Wheat bran, Japan O | 65.3 | 43.6 | 0 | 63.2 | 34 F |
| Wheat bran, Maine | 72.3 | 37.1 | 13.1 | 46.2 | 1 |
| Wheat bran, Maine | 74.2 | 38.4 | 13.6 | 45.7 | 1 |
| Wheat bran, Maine | 13.9 | 35.4 | 13.9 | 46.0 | 1 |
| Wheat bran, Texas | 57.3 | 50.4 | 8.6 | 55.9 | 62 |
| Wheat bran, Texas | 73.9 | 52.0 | 10.0 | 67.4 | 62 |
| Wheat bran, Texas | 60.2 | 58.6 | 3.1 | 39.3 | 99 |
| Wheat bran, Texas | 48.5 | 64.7 | 7.4 | 43.6 | 99 |
| Average (11) | 59.9 | 50.0 | 7.9 | 54.1 | |
| Wheat, Kalugin | 57.8 | 51.1 | 25.1 | 92.8 | 2 F |
| Wheat, Kalugin | 56.1 | 59.3 | 31.9 | 93.8 | 2 F |
| Wheat, Lehmann, Germany, O | 77.1 | 39.1 | 0 | 86.6 | 9 F |
| Wheat, Japan O | 80.2 | 40.3 | 5.6 | 90.5 | 35 F |
| Wheat, Japan O | 76.5 | 39.0 | 9.0 | 90.9 | 35 F |
| Wheat, Japan O | 84.3 | 41.2 | 9.8 | 91.7 | 35 F |
| Wheat, Japan O | 80.3 | 51.6 | 5.4 | 92.2 | 35 F |
| Wheat, Japan C | 76.2 | 30.9 | 0 | 89.0 | 36 F |
| Wheat, Japan C | 83.7 | 44.5 | 3.1 | 88.3 | 36 F |
| Wheat, Japan C | 74.9 | 30.0 | 0 | 86.2 | 36 F |
| Wheat, Japan C | 73.6 | 34.6 | 0 | 87.3 | 36 F |
| Wheat, Japan C | 82.6 | 34.6 | 0 | 89.4 | 37 F |
| Wheat, Japan C | 79.4 | 54.5 | 0 | 89.4 | 37 F |
| Wheat, North Carolina | 62.1 | 52.6 | 15.1 | 88.4 | 31 |
| Wheat, North Carolina | 62.9 | 28.3 | 0.4 | 87.3 | 31 |
| Wheat, North Carolina | 61.1 | 25.2 | 12.2 | 83.9 | 31 |
| Wheat, North Carolina | 61.5 | 47.6 | 4.9 | 85.4 | 31 |
| Wheat, North Carolina | 62.5 | 44.9 | 3.8 | 88.8 | 31a |
| Wheat, North Carolina | 60.2 | 28.0 | 1.4 | 86.8 | 31a |
| Wheat, whole, U. S. D. A | 77.4 | 58.8 | 0 | 88.9 | 26 |
| Wheat, whole, Texas | 80.1 | 62.2 | 36.8 | 92.4 | 59 |
| Wheat, whole, Texas | 77.0 | 58.5 | 27.9 | 92.9 | 59 |
| Wheat, whole, Texas | 81.5 | 67.6 | 46.1 | 90.2 | 74 |
| Wheat, whole, Texas | 73.6 | 70.8 | 29.0 | 88.0 | 74 |
| Wheat, Halsian C | 88.2 | 53.5 | 0 | 89.4 | 38 F |
| Wheat, Halsian C | 86.8 | 52.1 | 0 | 89.1 | 38 F |
| Wheat, Little Joss C | 86.9 | 34.9 | 6.7 | 89.3 | 39 F |
| Wheat, Little Joss C | 86.5 | 35.8 | 4.8 | 89.3 | 39 F |
| Wheat, hard, Maine | 71.3 | 56.9 | 0 | 80.8 | 13 |
| Wheat, soft, Maine | 71.7 | 60.2 | 17.1 | 90.3 | 14 |
| Wheat, soft, Maine | 57.0 | 68.6 | 0 | 89.6 | 14 |
| Wheat, soft, Maine | 69.8 | 50.6 | 0 | 87.0 | 14 |
| Wheat, soft, Maine | 77.3 | 45.1 | 0 | 88.1 | 14 |
| Wheat, soft, Maine | 78.7 | 47.7 | 0 | 87.7 | 14 |
| Average (34) | 74.0 | 47.1 | 8.7 | 88.9 | |
| Wheat middlings 8 5% fiber, North Carolina | 79.3 | 42.2 | 11.1 | 59.0 | 42 |
| Wheat middlings 8.5% fiber, North Carolina | 75.2 | 41.3 | 10.0 | 57.2 | 42 |
| Wheat middlings 8.5% fiber, North Carolina | 72.0 | 43.2 | 10.2 | 58.1 | 42 |
| Wheat middlings 8.5% fiber, North Carolina | 76.1 | 45.2 | 10.1 | 63.1 | 42 |
| Wheat middlings 8.5% fiber, North Carolina | 74.9 | 42.2 | 9.9 | 57.3 | 42a |
| Wheat middlings 8.5% fiber, North Carolina | 75.1 | 42.0 | 10.1 | 56.9 | 42a |
| Wheat middlings 8.5% fiber, North Carolina | 75.2 | 69.6 | 3.7 | 59.1 | 49 |
| Wheat middlings 8.5% fiber, North Carolina | 79.8 | 73.2 | 4.3 | 63.1 | 49 |
| Wheat middlings 8.5% fiber, North Carolina | 77.8 | 74.3 | 4.1 | 62.9 | 49 |
| Average (9) | 76.2 | 52.6 | 8.2 | 59.6 | |

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## REFERENCES TO DIGESTION EXPERIMENTS

Numbers.

1F- 4F I. Kalugin (1896). Maly, Jahresbericht, 810.
5F- 7F W. Von Knierem (1900). Landw. Jahrbucher, *29*, 518.
8F S. Paraschtschuk (1902). Journ. Fur Landwirtschaft, 15.
9F-10F F. Lehmann (1904). Centralblatt fur Agriculturchemie, 417.
11F-16F W. Voltz (1909). Landw. Jahrbucher, *38*, 553.
17F-37F T. Katayama (1924). Bulletin of the Imperial Agric. Exp. Station, Japan, *3*, No. 1.
38F-39F E. T. Halnan (1926). Journ. Agric. Sci., *16*, 451.
1 -18 J. M. Bartlett (1911). Bulletin 184, Maine Agr. Exp. Sta.
19 -24 Fields and Ford, Bulletin 46, Oklahoma Experiment Station.
25 -28 E. W. Brown (1904). U. S. Department of Agriculture, Bureau of Animal Industry, Bulletin No. 56.
29 -49 B. F. Kaupp and J. E. Ivey (1923). North Carolina Agr. Exp. Station, Technical Bulletin No. 22.
50 -112 Texas Experiment Station, this Bulletin.

## SUMMARY AND CONCLUSIONS

(1) This Bulletin contains a report on 63 digestion experiments with poultry, with a compilation of all other digestion experiments with poultry that could be found.

(2) Poultry have little power to digest crude fiber, and the digestibility of feeds which contain much crude fiber is low.

(3) Poultry have lower digestive power than ruminants for feeds containing crude fiber, such as whole oats, whole barley or wheat bran. There is little difference between the digestive power of ruminants and poultry for feeds low in crude fiber, such as corn, milo, or oat groats.

(4) The digestion coefficients for protein and ether extract vary more for poultry than for ruminants for the feeds compared. The difference in the variation with nitrogen-free extract is small.

(5) Although the basis for calculating the energy-production coefficients for poultry feeds is not satisfactory, such coefficients are given since they probably more nearly express the feeding value than do the digestion coefficients, and they can serve as a basis for further work.

(6) The approximate average composition, assumed minimum guarantee, digestible protein and productive energy are given for a number of poultry feeds.

(7) The composition and feeding values of mixed feeds for poultry may be calculated from the data given.